

Implementation and Validation of a Fully Automated VMAT TBI Treatment Planning Workflow

M. Ahmad, J. Brooks, L. Fong, J. Antolak,

A. Veres, J. Pursley, J. Kavanaugh, S. Lester, W. Breen, J. Lucido.

Department of Radiation Oncology, Mayo Clinic, Rochester, MN.

Purpose

To evaluate the dosimetric performance of an in-house developed fully automated VMAT total body irradiation (TBI) treatment planning platform.

Methods

An automated VMAT TBI treatment planning platform was developed and retrospectively applied to a small patient cohort to generate clinically acceptable treatment plans. Plans were computed using Eclipse AAA algorithm with 6 MV photon energy. Full arcs were used for isocenters in regions with small lateral separation of the patient PTV contour, while partial arcs, with lateral isocenter shifts, were used for regions with large lateral separation. For independent secondary dose calculation, within the treatment planning system, the workflow utilized the plan sum generated by the VMAT TBI application to merge all individual plans into a single composite plan for external dose verification. In the external QA system, the original individual plans were used for delivery validation, whereas the merged composite plan was used exclusively for secondary dose verification of the full-body PTV.

Results

Preliminary simulations of VMAT TBI treatment planning achieved the following dosimetric results for adult patients: PTV D95%=93.1%±2.7%, V120%=1.53%±0.57%, mean lung dose =73.1%±3.6%, mean kidney dose = 79.5% ± 0.63%, and mean brain dose = 83.1% ± 2.45%. For secondary dose verification, differences between TPS-generated plan sum and composite plan dose were assessed and found to be clinically insignificant for OARs and PTVs. Using 5%/3mm gamma criteria, independent dose verification achieved a gamma passing rate of 98.13% ± 0.68% when comparing plan dose calculated by the TPS AAA algorithm versus the dose calculated by the collapsed cone algorithm in the external QA system.

Conclusions

Automated treatment planning and secondary dose calculation are critical for streamlining complex VMAT TBI workflows. Integrating composite plan computation eliminates requirement for external dose summation, which improves efficiency and consistency.